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GEOGRAPHICAL RECORD

NORTH AMERICA

The Navajo Country. The Navajo, Apache, and Hopi Indian reservations of Arizona and New Mexico and the areas immediately about them form a geographic province of singular interest in regional geography, and one practically unknown until the publication by H. E. Gregory of an article entitled ''The Navajo Country'' in the former *Bulletin* of this Society (Vol. 47, 1915, pp. 561-577 and 652-672). Prof. Gregory has extended his writings since that time and under the same title has now produced a government report on the water supply of the region, including notes on the geology, topography, climate, vegetation, and early exploration. The field surveys covered the period 1908-1913; and the published report represents an extensive and important reconnaissance survey. It will long be practically the sole source of geographic information on a remarkably interesting portion of our domain where man's adaptation to a rugged and desertic land is of the most extreme kind.

The photographs deserve special mention in that they represent to an unusual degree the characteristic as well as the striking geographic and geologic aspects of the country. A large map (Pl. 1) shows the routes of earlier scientific expeditions, the locations of buildings, the relief (by hachures), the drainage, and the boundaries of the geographic provinces. The forest map (Pl. 19) by G. A. Gutches is a real contribution and brings out in a striking manner the effects of relief upon rainfall and vegetation. It is with respect to these features that the plastic character of the Indian population is so well expressed. The report supplies a broad physical basis for further research, though its usefulness would have been enhanced by a general summary of conclusions.

There should soon be undertaken a thoroughly scientific anthropogeographic investigation of the desert western country (if possible in connection with the next census) to the end that we may ultimately have a population map showing the *real* distribution of the people. Jefferson's studies, and particularly his paper entitled ''Utah, the Oasis at the Foot of the Wasatch'' (*Geogr. Rev.*, Vol. 1, 1916, pp. 346-358) emphasize the striking distribution of the belts of desert population as brought out on maps whose boundaries follow natural division lines and not the borders of minor political divisions that have no diagnostic value.

Avalanche Wind Near Juneau, Alaska. Winds resulting from avalanches or landslides are an interesting group in any complete classification of the winds of the world, but are of relatively rare occurrence. On Jan. 26, 1917, as a result of a heavy snowslide into Gold Creek Gulch, an avalanche wind occurred near Juneau, Alaska. The force of the blast generated by the down-rushing snow was sufficient to demolish some cabins and to carry their dêbris up the opposite slope, together with some 4 x 4-inch timbers and 12 x 2-inch cross planks of a board walk. A large piece of concrete chimney was also carried up the slope. The wind had a lateral as well as forward component, for it destroyed a cabin 500 feet down the gulch in the direction of Juneau, the edge of the city being only about a quarter of a mile away. The wind was felt throughout the city. A blinding whirl of snow came with the wind, and enveloped the city in semi-darkness for several minutes. R. DeC. Ward.

A New Map of the Physiographic Divisions of the United States. The Association of American Geographers, organized in 1904, has been one of the most important instruments in America for the encouragement of geographic research. Among its achievements since its foundation there is certainly none other so important as the physiographic map of the United States produced by a special committee of which Prof. N. M. Fenneman was chairman (Physiographic Divisions of the United States, *Annals of the Assoc. of Amer. Geographers,* Vol. 6, 1916, pp. 19-98; map, Pl. 1, scale 1:7,000,000). We recognize in this work two qualities—the one scientific, the other diplomatic. Professor Fenneman devoted the best part of a year to the task of compiling the essential facts and arranging them in systematic order. It was then necessary to secure discussion on the part of the members of the committee and concurrence on questions of boundary delimitations. When we consider the vast extent of the territory involved and the salient personalities of the men who were bound to be associated on such a committee, it increases our admiration for the happy results which have been achieved under Professor Fenneman's leadership. Every other member of the committee, and especially M. R. Campbell of the U. S. Geological Survey, likewise deserves the thanks and congratulations of the Association of American Geographers.

The detailed characterization of the article and the map is outside the purpose of this notice. We need indicate only a few leading features. The United States is divided into primary divisions, as represented in a general way on maps heretofore known to physiographers; but each division is further divided into provinces and sections. Of the former there are 24 and of the latter 88, counting undivided provinces. The characteristics of each minor section, expressed in terse technical language, are particularly helpful. The assistance given by such a characterization in further research is beyond praise. It matters little that the boundaries of the provinces will be subject to minor changes in later years or that the technical descriptions may require modification as each minor section becomes better known through detailed surveys. The point of chief importance is that we now have an authoritative beginning for the interpretation of the human life of the United States. Hereafter the regional geography of the country will be written on an entirely new basis.

No better service could now be rendered than that of interpreting the distribution of population in terms of physiographic regions. Here lies the great importance to geographical science of the next census. It would be an almost inconceivable neglect of opportunity to have the population maps drawn without reference to the boundaries of the physiographic provinces. Detailed physiographic field work is essential to supplement the statistical facts and this ought to be done in co-operation with some physiographic committee which would actually and precisely delimit the details of each boundary in the field. The county unit is too gross for this purpose and even the township unit ought to be split in critical cases. This would afford geographers an opportunity for the first time to make a really scientific study of the distribution of population. It is not meant to imply that physiographic features are a primary control of distribution. But relief, and all that goes with it, is in many cases the primary control; and the extent to which this control is exercised can never be demonstrated—physiographic influence can never be isolated from other influences—until a study is undertaken on this plan. The Census Bureau will surely not fail to seize this great opportunity.

Corn-Growing under Droughty Conditions in the United States. The detailed study of climatic data in connection with agriculture is one of the increasingly important developments of modern climatological research. It is a significant fact that many of the recent publications emanating from the Bureau of Plant Industry, the Office of Farm Management, and the Weather Bureau are concerned with these economic aspects of climatology. Clearly, *economic climatology* is now of sufficient importance to warrant the use of this term. Messrs. C. P. Hartley and L. L. Zook, of the Bureau of Plant Industry, have been investigating corn-growing in the drier portions of the United States (*Farmers' Bull. 773,* U. S. Dept. of Agric., Washington, 1916). Farmers from the East have for fifty years been attempting to raise corn in the semi-arid West. The seed and the methods used were almost always those of the East, not adapted to western climatic conditions and hence often resulting in failure. It is the purpose of this bulletin to indicate the causes of these failures and to show how failures may become less frequent and less serious. An improvement of the yield of corn per acre and a less wasteful utilization of the crop are important. The average acre yield is now less than one-half what it might easily be, and while it is increasing in the older states, it has remained about 27 bushels for the country as a whole. This fact has been largely due to the expansion of corn-growing into semi-arid and otherwise unsuitable regions. The cultivation of corn under droughty conditions "is largely a matter of taking chances with seasonal conditions." On the other hand, there are certain controllable conditions of soil and seed which frequently determine the success or failure of the crop. It is with these latter factors that this bulletin is concerned. R. DeC. Ward.

New York as a World Market for Cacao. In 1915 New York became the coffee capital of the world and the clearing house for Europe. That a similar position will be occupied in respect of cacao appears probable (*Commerce Repts.,* 1917, No. 66). During the fiscal year ending June 30, 1916, advance in this direction continued; the re-exports of cacao were about $31,500,000 against $29,000,000 in 1915 and $4,500,000 in 1914. As the leading buyer of the crude product New York made great gains also, the increase in quantity and value being respectively 26 per cent and 53 per cent over 1915, itself a record year. Contributory to these movements are changes in the ports of shipment. Several cacao-producing countries are now shipping direct to the United States for the first time. Such are British Guiana, Peru, the Dutch West Indies, French Africa, and, most important, British West Africa, from which last place the output has greatly increased in quantity and improved in quality. Importation from British West Africa was only exceeded by that from the Dominican Republic, Brazil (which showed a gain of 300 per cent over the previous year), and Ecuador.

SOUTH AMERICA

A New Port on the West Coast of Peru. The desert coast of Peru has over thirty main valleys, each of which has an irrigated alluvial floor, a port at the valley mouth or in some sheltered curve of the coast near by, and barren desert country between it and the neighboring valleys on either hand. The desert coastal strip is narrow and, save for Lima and Arequipa, there are no really large towns. Each valley is notably independent. Trade and even travel are by way of the sea rather than overland. The effect has been to call into existence a large number of small "ports." In the main these are distinctly primitive. Callao is the only one in which ships can discharge their cargoes directly upon the docks. All others are reached by lighters which in turn discharge at steel piers built out beyond the reach of the surf as at Eten or in some sheltering cove as at Mollendo. The expense of huge modern port works could not be borne by any one of the valleys and since railways run down to the coast, and not along it, no valley can attract the trade of a number of adjacent valleys. It follows that small steamers, easy to build and with moderate operating losses due to port delays, serve the commercial interests better than large vessels of the trans-atlantic type.

On the map, Fig. 1, it will be seen that Salaverry is one of the chief ports of Peru. It is the outlet for one of the richest valleys of the coast. But it is exposed to the strong surf; and therefore the sugar interests of Ascope, an interior town, have arranged for the construction of a new port at Malabrigo, which is sheltered by Malabrigo Point against the prevailing southwest winds. A railroad will connect the Ascope plantations with the new port and serve not only the sugar trade but mining interests as well, thereby competing seriously with the dock and railway at Salaverry and making one more port of call for the already over-crowded schedules of the west-coast steamers (*Commerce Repts.*, March 30, 1917, No. 74). According to Vallejo's Mapa del Perú published in 1912 by the Sociedad Geográfica de Lima (scale 1:1,500,000) the distances in straight lines from Ascope to Malabrigo and from Ascope to Salaverry are 22 miles and 37 miles respectively.

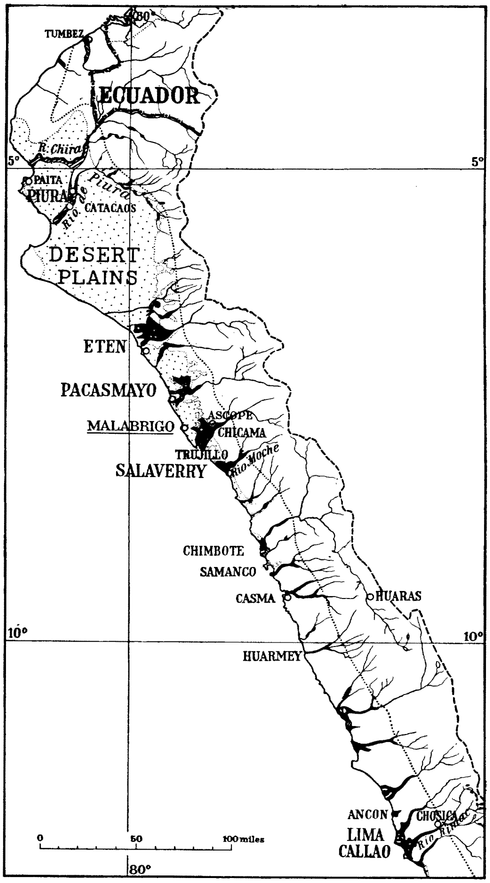

FIG. 1—The position of the port of Malabrigo (underlined) in relation to the neighboring ports of Peru.

The Effects of the War on the Chilean Nitrate Region. One of the first effects of the war was greatly to depress the nitrate industry—practically the sole basis of the commercial life of the pampa region in northern Chile. Banks failed or suspended payment; longshoremen out of work threatened disorder; and many of the nitrate *oficinas* were obliged to close. Hundreds of laborers came down from the pampa to the coast towns where, in large numbers, they slept on the docks while waiting for the next steamer. The government offered free passage to all Chileans who wished to return to the farms of the south and to all Peruvians and Bolivians who cared to return to their respective countries. No such exodus had ever before been seen in the nitrate country (Conditions in Chilean Nitrate District, *Commerce Repts.*, Sept. 25, 1914, No. 225). The total number of unemployed in the nitrate plants and coast ports reached 33,000, half of whom were heads of families, according to the report of the commission appointed to take care of the unemployed arriving at Iquique (*Commerce Repts.*, Dec. 9, 1914, No. 288). The significance of these figures arises from the fact that by far the larger part of the population in the whole country is dependent upon the 100,000 people directly engaged in nitrate production or trade. Furthermore, 58 per cent of the total customs revenues of the whole country are derived from the import and export duties of the nitrate region. In some years the export duties on nitrate have been not less than 85 per cent of the total national income (W. S. Tower: The Nitrate Fields of Chile, *Pop. Sci. Mo.*, Vol. 83, 1913, pp. 209-230. This is the best geographic article on the nitrate country yet published.) The export duties on nitrate and iodine normally produce $28,000,000 American gold. The government has for years maintained its employes and carried out improvements in other parts of Chile largely from revenues obtained from the nitrate region. As shown in Fig. 1, the production of nitrate steadily increased until the war broke out.

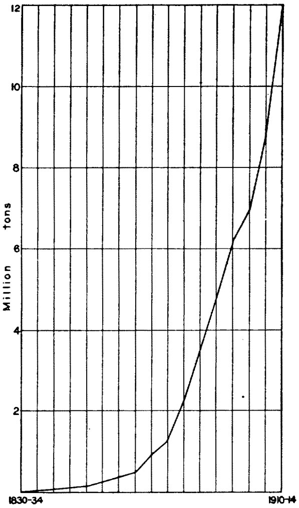

FIG. 1—The production of nitrate in Chile by five-year periods. Figures for 1830-1839 are from Paz Soldan: Geografía del Perú; for 1840-1894 from Ortúzar: Chile of To-day; for 1895-1914 from F. López Loayza: La Provincia de Tarapacá and from current numbers of *The South American Journal*.

The depression in the mining business has now been measurably overcome, owing to unprecedented prices for nitrates and copper and the huge sales of these products in 1916. The paper *peso* has advanced in value from 17½ cents to 22½ cents and the chronic annual deficit was changed in 1916 to an actual surplus (Prosperity in Chile, *Commerce Repts.*, March 20, 1917, No. 65).

Since Germany formerly took about 30 per cent of the nitrate exported, and since that country has probably developed economic methods for the extraction of nitrate from the air which will probably make her independent of Chilean nitrate, much attention has been given of late to the development of more economical business methods and to the extraction of a higher percentage of nitrate from the raw caliche (*Commerce Repts.*, Nov. 10, 1916, No. 10).

A New Determination of the Area of Peru. A new calculation of the area of Peru places the superficial extent of the country at approximately 534,000 square miles. This figure, obtained by measurement from Raimondi's map on the scale of 1:500,000, is a reduction of 20 per cent on that of 1876 carried out in a similar way (*Bol. Soc. Geog. de Lima*, Vol. 31, 1915, pp. 45-50). The principal loss of territory has been sustained in Loreto, the vast department of the eastern plains where Peru meets the republics of Colombia, Ecuador, Bolivia, and Brazil. Between Peru and the two latter countries boundary disputes were settled in the agreement of 1909 and since that time delimitation of the frontiers had been actively prosecuted. The work of the Peru-Bolivia Commission has been recently described by Colonel Holdich (*Geogr. Journ.*, Vol. 47, 1916). Boundaries between Peru and Colombia and Ecuador are still in dispute. Since 1879 Peru has also lost the nitrate province of Tarapacá. The above calculation, however, includes Tacna department with an area of 12,500 square miles.

AFRICA

Mineral Wealth of Katanga, Africa. Professor René d'Andrimont, in charge of geology at the Agricultural Institute of Belgium, has written a paper "Le Katanga et ses richesses minérales" (*La Nature*, No. 2255, 1916, Dec. 16, pp. 385-391), in which he concisely discusses not only the important metals, diamonds and coal of the southeastern part of the Belgian Congo but also their limited occurrence northward to the west of Lake Tanganyika. He says the metals are found especially in faulted areas, where the movement of metalliferous magmas to or towards the surface was facilitated. Copper, tin, gold, and diamonds were discovered in these zones of fracture. The most important gold deposits, however, have been found at Kilo, to the northwest of the great fracture-bordered graben filled by Lake Tanganyika, where gold to the amount of $2,000,000 has been mined in the past few years. No gold in paying quantities has yet been found in Katanga though there are many traces of it. Further search may be amply repaid, as in the case of the adjoining colony of Rhodesia.

The Ubamba depression, to the northwest of Elizabethville, is estimated by British and Belgian experts to contain tin worth $12,000,000. In a depressed area adjoining (Kundelungu), the English have found ''pipes'' containing diamonds as in the diamond mines of the Union of South Africa. Investigation is not yet so far advanced as to show whether diamond mining will be profitable. Copper is still the great mining industry of Katanga. The carbonate copper beds in the south are among the richest in the world, the mineral yielding from 12 to 14 per cent of metal. An adequate explanation of the very irregular distribution of these ores will not be found till the beds are known to their depths. Their upper part is in the form of sediments impregnated by carbonates.

Coal is the most recent discovery in Katanga. Two areas of coal have thus far been found. One of them is only six miles from the west coast of Lake Tanganyika on the line of the railroad connecting the lake with the Congo River and completed shortly before the war began. The four beds found there cover an area of some thirty square miles. This coal is now used on the Tanganyika steamers. The other coal find is in the region of Bukama which stands on the last navigable stretch of the upper Congo and is now being connected with Elizabethville by rail. This road will link the Congo with the great copper field that extends between Elizabethville and Kambove. CYRUS C. ADAMS.

Winds Over Northern Africa. In his presidential address before the Royal Meteorological Society, Major H. G. Lyons, F.R.S., considered the distribution of pressure and the air circulation over Northern Africa (*Quart. Journ. Roy. Met. Soc.*, Vol. 43, 1917, pp. 116-150). All of North Africa is arid. Some rain falls on the Mediterranean coast in winter, but south of the line Timbuktu-Lake Chad-El Obeid a fair amount of rain falls in July to September. The climatic characteristics of the region as a whole are high temperatures, large temperature ranges, low relative humidity, an almost cloudless summer, a moderate cloudiness in winter, and generally moderate wind velocities. These conditions extend in winter to 10° N., and in some places, as in the Egyptian Sudan, to 5° N. Major Lyons is of the opinion that the northerly and northeasterly winds of the French Sahara, and the northerly winds of the Nile Valley, may properly be called ''trade winds'' because they are maintained throughout the year as a steady circulation. They are not, however, to be regarded as convective currents forming part of a circulation between hotter and cooler regions, determined by such a difference of temperature. They are rather ''geostrophic'' winds, flowing around the Azores ''center of action,'' whose influence extends to northeastern Africa in winter. In summer, the low pressure system of southern Asia maintains the northerly flow of air over Egypt and the surrounding region. R. DEC. WARD.

AUSTRALASIA AND OCEANIA

An Expedition to Easter Island and Its Results. Easter Island has long provided one of the most fascinating puzzles of the Pacific Seas. Towards the solution of its mysteries the Scoresby Routledge Expedition has made an important contribution. The expedition left England in 1913 and was absent three years, of which time about sixteen months were spent on the island. During this time supplies were secured from the Chilean mainland 2,000 miles distant.

From its discovery in 1722 by the Dutch navigator Roggeveen the isolated volcanic isle has been known for its strange megalithic statues (see The Voyage of Captain Don Felipe Gonzales to Easter Island 1770-1: Preceded by An Extract from the Official Log of Mynheer Jacob Roggeveen in 1722, *Hakluyt Soc. Publs.*, 2d Ser., No. 13, 1908). To the exposition of the culture they represent the work of the expedition was devoted. It embraced two fields—archeological and ethnological. The former included description and measurement of the great stone figures and a study of their distribution. The distribution is three-fold. They are related to the wrought stone terraces facing the shores; they are scattered on the volcanic slopes; and they line the quarry wherein all were fabricated. The statues that once stood on the terraces have all been overthrown, apparently in tribal war and within historical time. The statues on the slopes, also prostrate, appear to have bordered the roads leading from the quarry; on the longest road they must have been placed every few hundred yards apart for a distance of six miles. Most interesting are the statues in the quarry. In various stages of completion they number 150. The whole process of carving even to the number of workmen employed on them is clearly seen; and the tools, the harder obsidian scouring in the easily wrought volcanic ash, have been found. It is astonishing to learn that a figure could probably be completed in a fortnight. No hint as to the means of transportation, a much more arduous task than the carving, could be discovered.

From the ethnological point of view the last 50 years have been the most disastrous in the island's history. During the expansion of the Peruvian cotton industry in the early sixties slave raiders from Peru carried off half of the native population, including the principal men. Today only 250 islanders exist. Since a Chilean company started ranching on the island they have been confined to a reservation. The raiders were immediately followed by Roman Catholic missionaries through whose efforts the old customs and traditions were prematurely curtailed. Knowledge of the stone statues and of the possibly related wooden images has practically disappeared. Detailed acquaintance with the wooden tablets bearing the unsolved hieroglyphic writing is fast vanishing, too. The old people, however, could remember the time in their youth when the writing was still a living part of their civilization but it was taboo to all the uninitiated and there now survives only one old man who had begun to learn the sacred art. One tradition remains in clear memory—the peculiar ''bird-cult'' that centred around the annual discovery of the first egg of the birds coming to nest on the island each spring.

From the surviving material the expedition appears to have secured practically all the data that the island can itself reveal. Further elucidation must be sought afield. In particular it is necessary to know more of the migrations in the Southern Seas whence rather than from the east the civilization of Easter Island seems to have come. Mrs. Scoresby Routledge's report of the expedition read before the Royal Geographical Society aroused much interesting discussion and in its published form (*Geogr. Journ.*, May, 1917) has prompted the appearance of other communications on the subject. Such is Notes on Easter Island by B. Glanvill Corney (*Geogr. Journ.*, July, 1917), in which is reviewed the account of Easter Island compiled by Paymaster Richards of the Challenger Expedition and contained in his manuscript diary.

Wind Direction Indicated by a Volcanic Cone. In their asymetrical contour the volcanic cones of Hawaii preserve a meteorological record in durable form. The typical elongation of the cones in a northeast to southwest direction bears witness to the steady prevalence of the northeast trade wind. Material in the process of ejection is naturally deflected to the leeward of the growing cone and its symmetry thereby destroyed. An exception to this general phenomenon is to be found in the Punchbowl, an old crater hill lying in the heart of Honolulu. The configuration of the Punchbowl indicates that during its formation the dominant wind blew from the southeast. Such a wind, named the ''Kona,'' blows erratically at infrequent intervals mainly during the rainy season. It is believed that the Punchbowl was built up in a single rapid explosion probably lasting a few hours only. (Vaughan MacCaughey: The Punchbowl: Honolulu's Metropolitan Volcano, *Sci. Monthly,* June, 1916, pp. 607-613.)

The 1916 Census of Population in New Zealand. Some preliminary results of the 1916 population census of New Zealand are published in the Official Year-Book of that date. The population, exclusive of the Maoris and the residents of the Pacific islands annexed in 1901, is 1,099,044, representing a population density of between 10 and 11 to the square mile. To this the major divisions contribute unequally. North Island has 14.5 to the square mile, South Island 7.5. While the area of occupied pastoral land is far greater in South Island than in North Island the land under cultivation in the latter is nearly twice as great as in the former. In comparison with figures of the two preceding quinquennial periods the increase from 1911 to 1916 shows a marked drop, being about 9 per cent as compared with increases of 15 per cent from 1901 to 1906 and 13.5 from 1906 to 1911. The decline is accounted for by the curtailment of emigration since the beginning of the war and the withdrawal of troops for over-seas service. In 1913 the net gain of arrivals over departures amounted to more than 14,000; in 1915 it was reduced to 3,000.

PHYSICAL GEOGRAPHY

Frequency Curves of Climatic Phenomena. Successful agricultural practice requires a knowledge of the frequency of occurrence of unfavorable weather phenomena. Mean values, even single absolute extreme values, are obviously not satisfactory. H. R. Tolley, of the Office of Farm Management in Washington, has recently been giving special attention to this subject, and has brought out some results which are of immediate and practical use (Frequency Curves of Climatic Phenomena, *Monthly Weather Rev.*, Vol. 44, Nov., 1916, pp. 634-642). Normal frequency curves have been plotted for the date of last killing frost in spring (33 stations, 823 observations) and for annual rainfall (21 stations, 963 observations). The development of such diagrams, and the determination of the normal frequency curves, involves much labor and a certain mathematical ability, but there is no question about the practical importance of the results. A number of other frequency curves, and the numerical and mathematical data used in the computations, are included.

R. DeC. Ward.

Climatic Factors in Plant Life. As agriculture comes to depend more and more upon refined studies of climatic factors, empirical and wasteful experiment is rendered unnecessary. Some of the results of studies now under way are striking in their real practical importance. For example southern Ontario grows tobacco and grapes. Where else in Canada may equivalent climatic conditions be met? Not as might be supposed in merely ''milder'' regions. Victoria, British Columbia, has a longer period of active growth (268 days against 216 in Toronto), a longer frostless period (233 days against Toronto's 165), a slightly greater total of ''heat units'' for the year, and a much smaller sum of ''cold units.'' But Victoria has only four days of ''tropical heat'' to Toronto's 45 and a smaller number of heat units during the growing season. By days of ''tropical heat'' is meant days with mean temperature over 68° F. Active growth is considered to begin at temperatures of 41° F. or over. The terms ''heat units'' and ''cold units'' are used to describe total temperature effects. The heat unit is defined as a temperature of 1° F. above the freezing point continued for the duration of an hour; the cold unit is a similar measure below the freezing point. These and other temperature elements are set forth in a paper by J. Adams (The Quantitative Study of Climatic Factors in Relation to Plant Life, *Trans. Roy. Soc. of Canada, Section 9, Geol. and Biol. Sci.*, Ser. 3, Vol. 10, 1916, pp. 105-123). Besides the temperature factor the author also makes analyses of light, precipitation, evaporation and wind in relation to plant life. In particular he emphasizes the value of evaporation, the most significant factor that can be readily measured.